Small Business Innovation Research/Small Business Tech Transfer

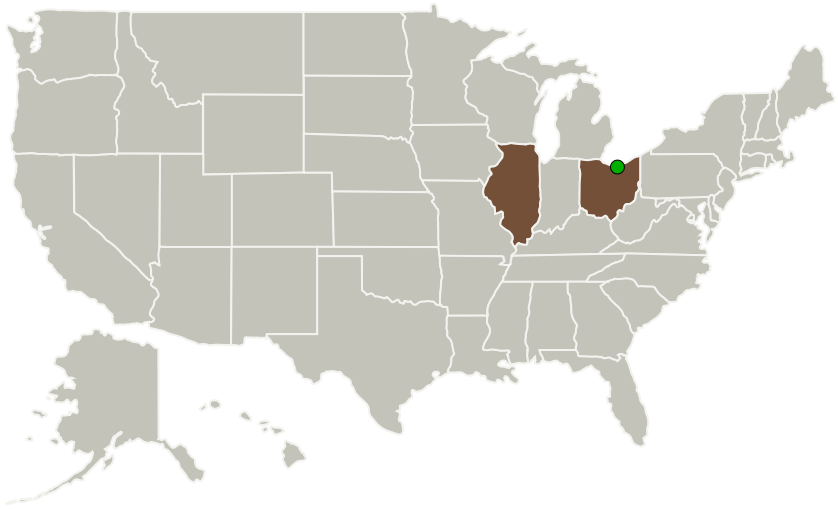
In-Flight Ice Accretion Hazard Mitigation with Low Surface Roughness Aluminum Airfoil, Phase I

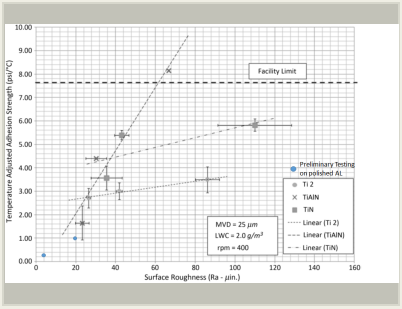
Completed Technology Project (2016 - 2016)

Project Introduction

Icing is a major problem for the aviation industry, but it has proven to be a difficult problem to solve as the physical processes that lead to icing are complex and interdependent. Recently, it has been shown that a 4X reduction in surface roughness resulted in a 250% decrease in ice-adhesion strength. Super polishing aluminum slurry and pad technology has been used in preliminary tests to polish aluminum airfoils to rms surface roughness levels to 100 nm and below. An aluminum surface polished to 10 nm surface roughness exhibited a 73% reduction in temperature adjusted ice adhesion strength at 1.7 psi. Designed experiments on polishing will be conducted to optimize the surface roughness that yields the lowest ice adhesion strength. Subsequently, the TiN erosion/corrosion coating will also be super polished after deposition to equivalent low surface roughness levels. The manufacturing process can be optimized for time and cost efficiency. A hybrid solution consisting of low surface roughness, a TiN erosion/corrosion coating, and thermal energy is proposed for icing mitigation.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Microengineered Metals, Inc.	Lead Organization	Industry	Yorkville, Illinois
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Illinois	Ohio

Project Transitions

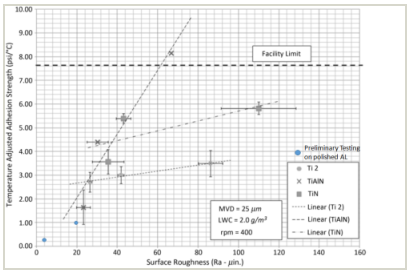
June 2016: Project Start

December 2016: Closed out

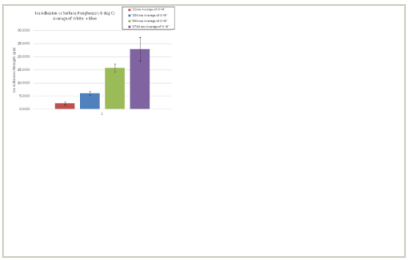
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140257)*

Images



Briefing Chart Image
In-flight Ice Accretion Hazard Mitigation with Low Surface Roughness Aluminum Airfoil, Phase I
(https://techport.nasa.gov/image/136794)



Final Summary Chart Image
In-flight Ice Accretion Hazard Mitigation with Low Surface Roughness Aluminum Airfoil, Phase I Project Image
(https://techport.nasa.gov/image/137243)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Microengineered Metals, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

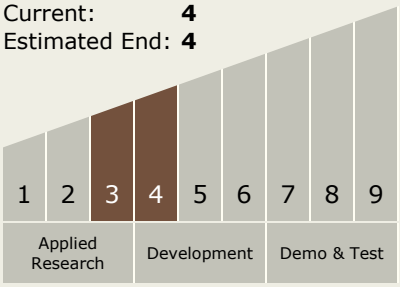
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Susan M Wilson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System